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Performance evaluation of agroindustrial wastes as adsorbents in the adsorption process of dyes in aqueous medium: a review

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In recent decades, there has been significant industrial growth worldwide, and the industry, in general, is responsible for the majority of pollution globally. Industrial waste is often discharged into aqueous media, which can pose various hazards to local fauna and flora, primarily because some of these wastes, such as dyes, can contaminate vast regions with small quantities. Currently, a variety of methods have been studied for the removal of these contaminants, with bioadsorption being one of the most studied methods due to its simplicity, low cost, and good performance, as well as the fact that the material is derived from agroindustrial waste and is practically available at no cost. Based on the above, the present study aimed to evaluate, through a literature review, different types of bioadsorbents for the removal of dyes from effluents generated by the industry. The research was conducted by collecting data from several articles, where aspects such as the type of adsorbent, modifications made, influence of the adsorbents' structure, and inherent operational parameters of the process were analyzed. It was possible to observe that the structures of the adsorbents directly influence their adsorptive capacity, as well as the removal efficiency; modified adsorbents generally showed better performance, such as phosphorylated coconut lignin (LCF), which achieved a superior result to natural lignin (LN); LCF was able to remove 94% of methylene blue (MB), while LN removed 83%, both at a concentration of 0.5g L-1. Operational effects such as the pH of the medium significantly influenced the process, as was the case with graphene oxide, which at pH 6 reached an equilibrium capacity of 70.86 mgg -1, while at pH 8 the value was 73.4 mg g -1. In a study conducted with Aptenia cordifolia, a natural adsorbent, the adsorbed amount of MB increased from 36.27 to 49.25 mgg -1 as the pH value changed from 2 to 11; this is due to the electrostatic interactions between the adsorbent and the adsorbate, as MB is a cationic dye. Agroindustrial wastes show strong potential as dye bioadsorbents; however, for better performance, a thorough study is necessary to evaluate the best conditions for the process.